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Chang et al.

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(54) **MECHANICAL PARKING GARAGE**

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E04H 6/20 (2006.01)

(52) **U.S. Cl.**
CPC ***E04H 6/22*** (2013.01); ***E04H 6/20*** (2013.01)

(58) **Field of Classification Search**
CPC E04H 6/20; E04H 6/22
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,647,647 A * 8/1953 Alimanestiano E04H 6/186 414/254
3,987,912 A * 10/1976 Leon Moyano E04H 6/18 414/239
4,109,804 A * 8/1978 Leon Moyano E04H 6/186 414/254
4,312,623 A * 1/1982 Allred E04H 6/22 414/231
5,678,972 A * 10/1997 Bockler E04H 6/18 414/234
6,328,521 B1 * 12/2001 Givati E04H 6/22 414/234
8,812,148 B2 * 8/2014 Kharkover E04H 6/225 700/218
9,631,390 B2 * 4/2017 Segal B65G 1/06

* cited by examiner

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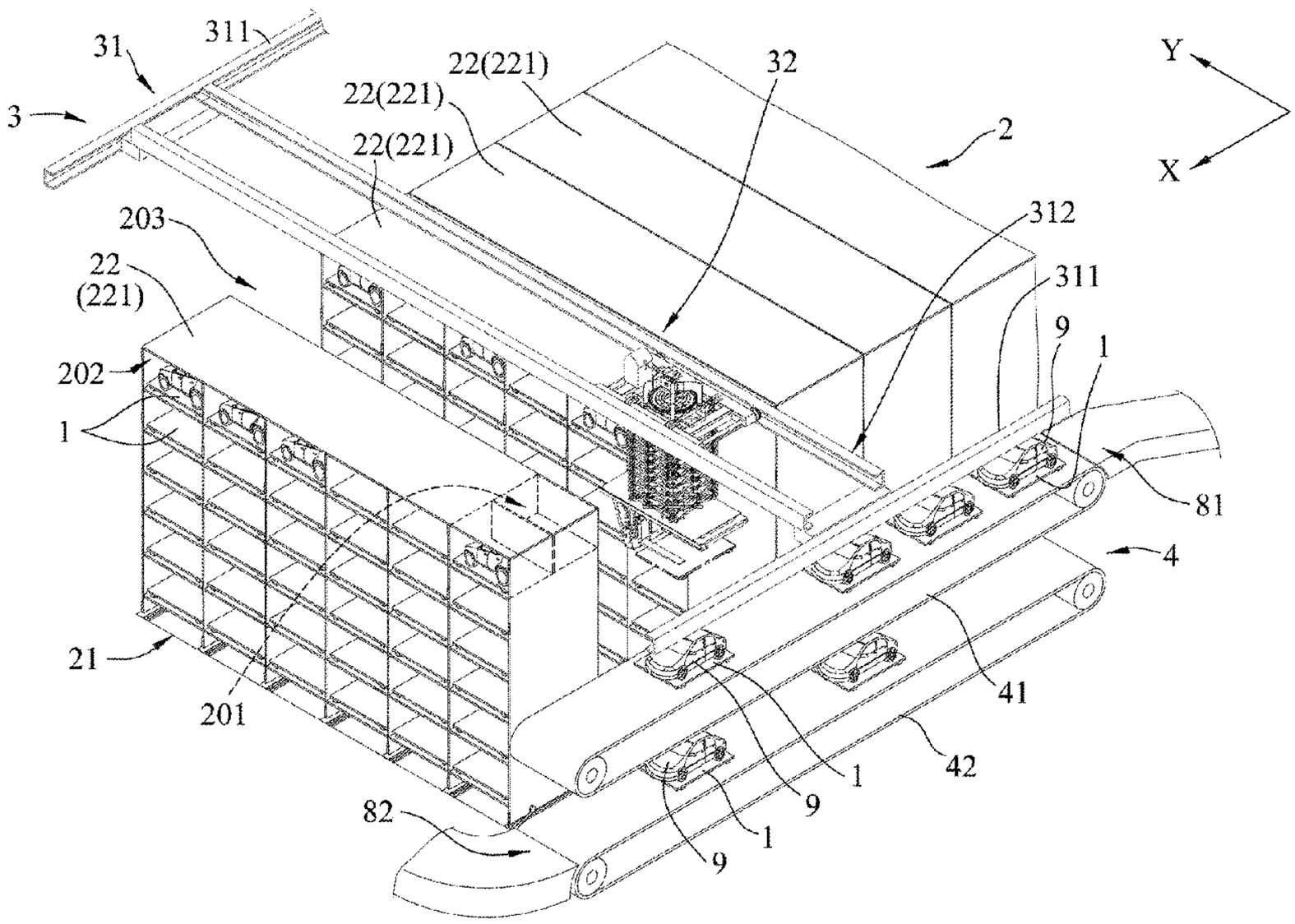
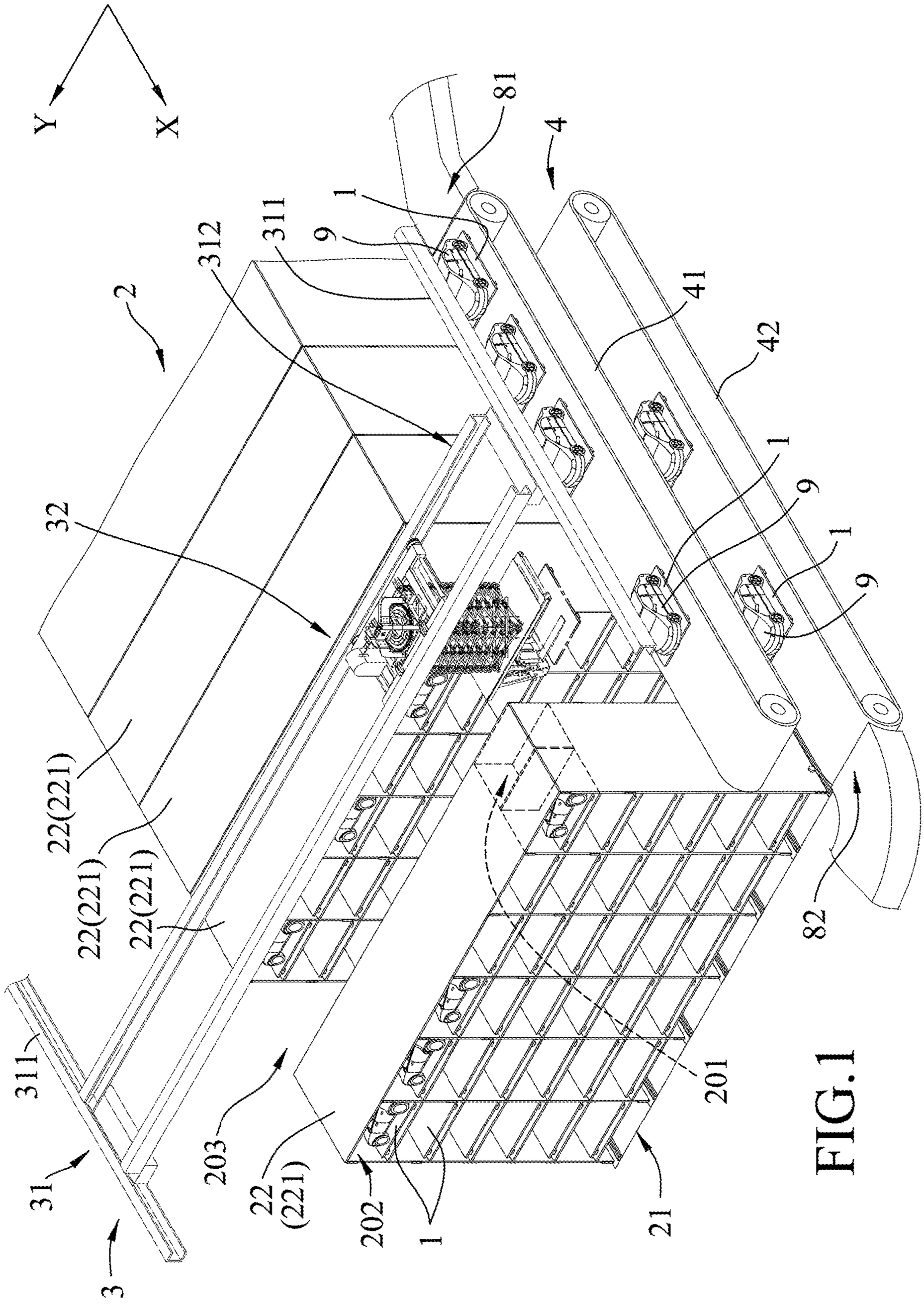
(57) **ABSTRACT**

A mechanical parking garage includes a plurality of pallets, a parking system including a rail track unit and a plurality of tower units, and a transporting system. Each tower unit is mounted on and slidable along the rail track unit, and has a plurality of first parking spaces, each of which is disposed for storing one of the pallets. The transporting system includes a rail mechanism mounted above the parking system, and a transporting mechanism mounted to the rail mechanism and being horizontally movable. Any adjacent two of the tower units are movable relative to each other between approximate state and a distal state. At the distal state, the adjacent two of the tower units define a transporting aisle therebetween.

10 Claims, 8 Drawing Sheets

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81
4
1
9
311
312
2
41
42
32
22(221)
22(221)
22(221)
1
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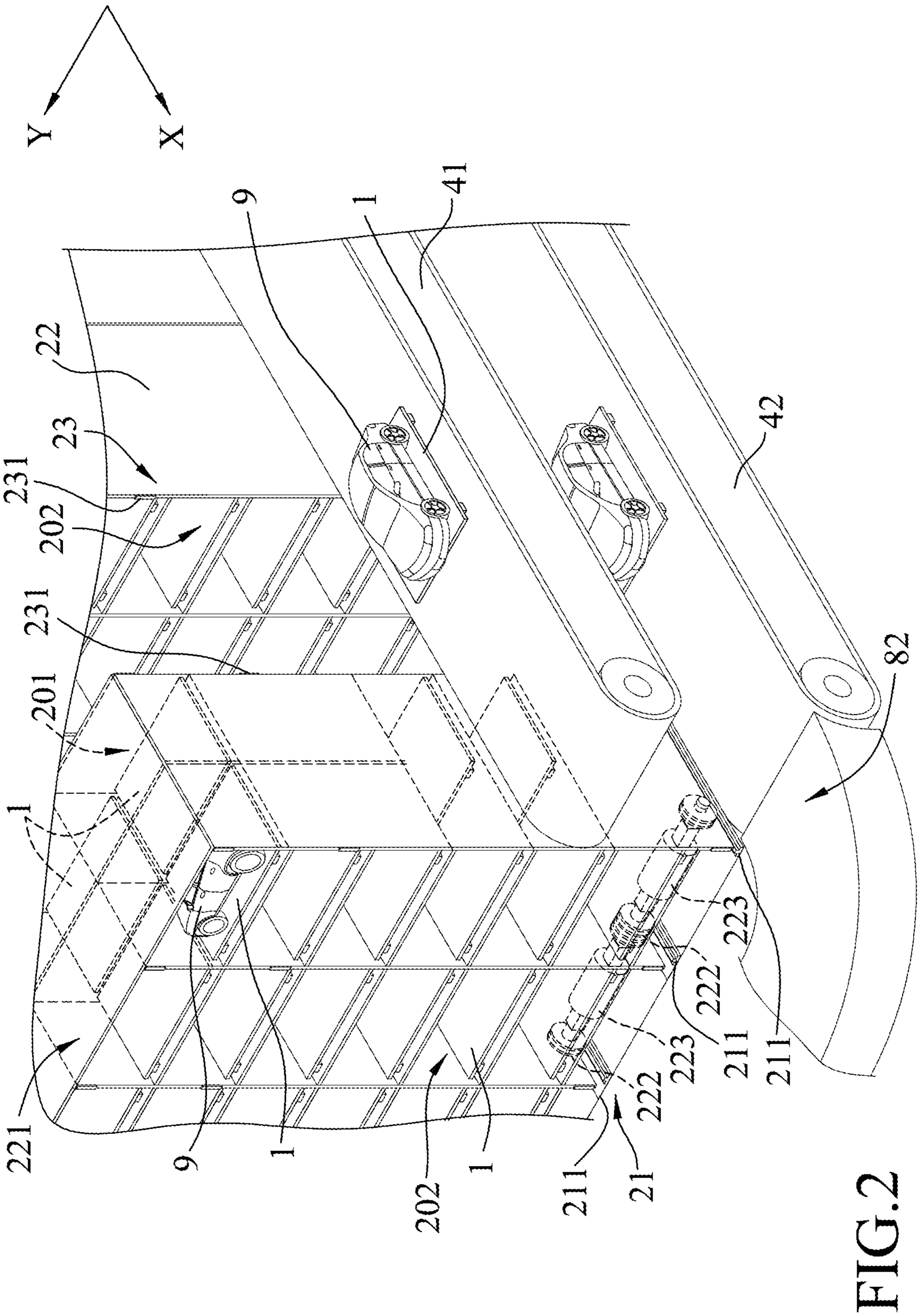
9
311
31
3
203
22
(221)
202
1
21
201
82

FIG.1


Y
X
9
1
41
22
23
231
202
231
201
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221
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211
21
222
223
211
222'
223
211

FIG.2

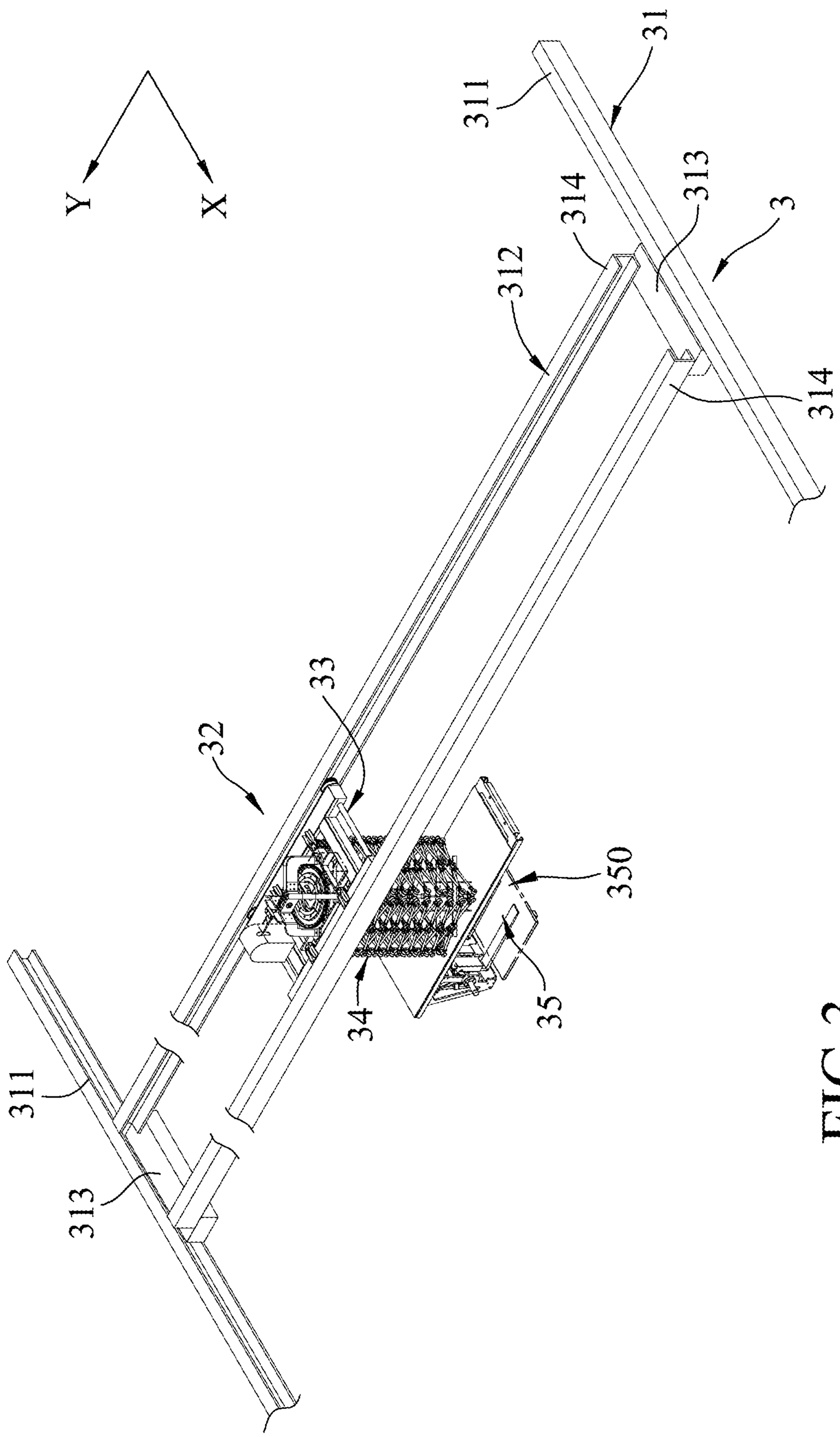
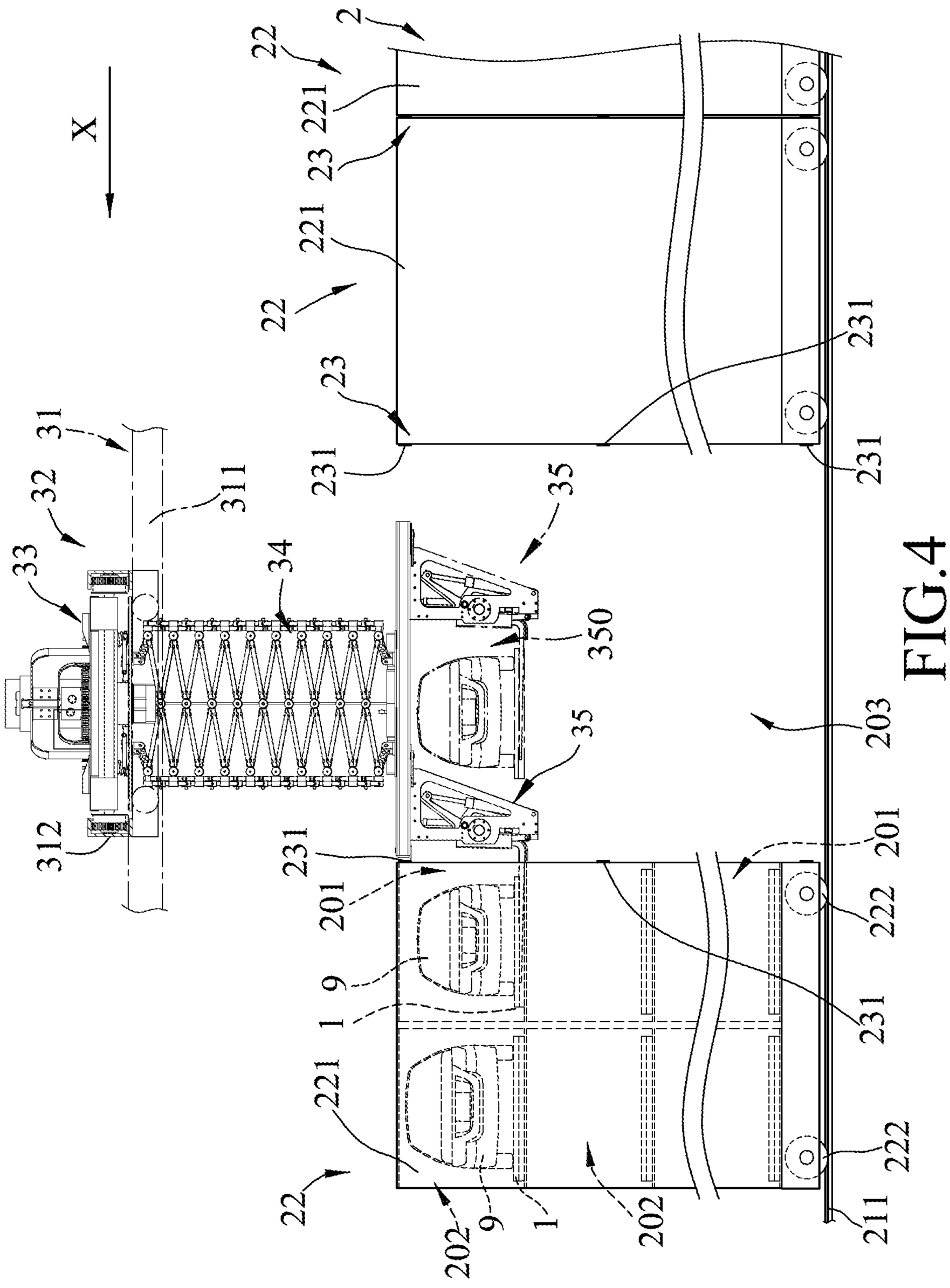


FIG.3


X
2
22
221
23
221
22
231
23
231
231
31
32
311
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34
35
350
35
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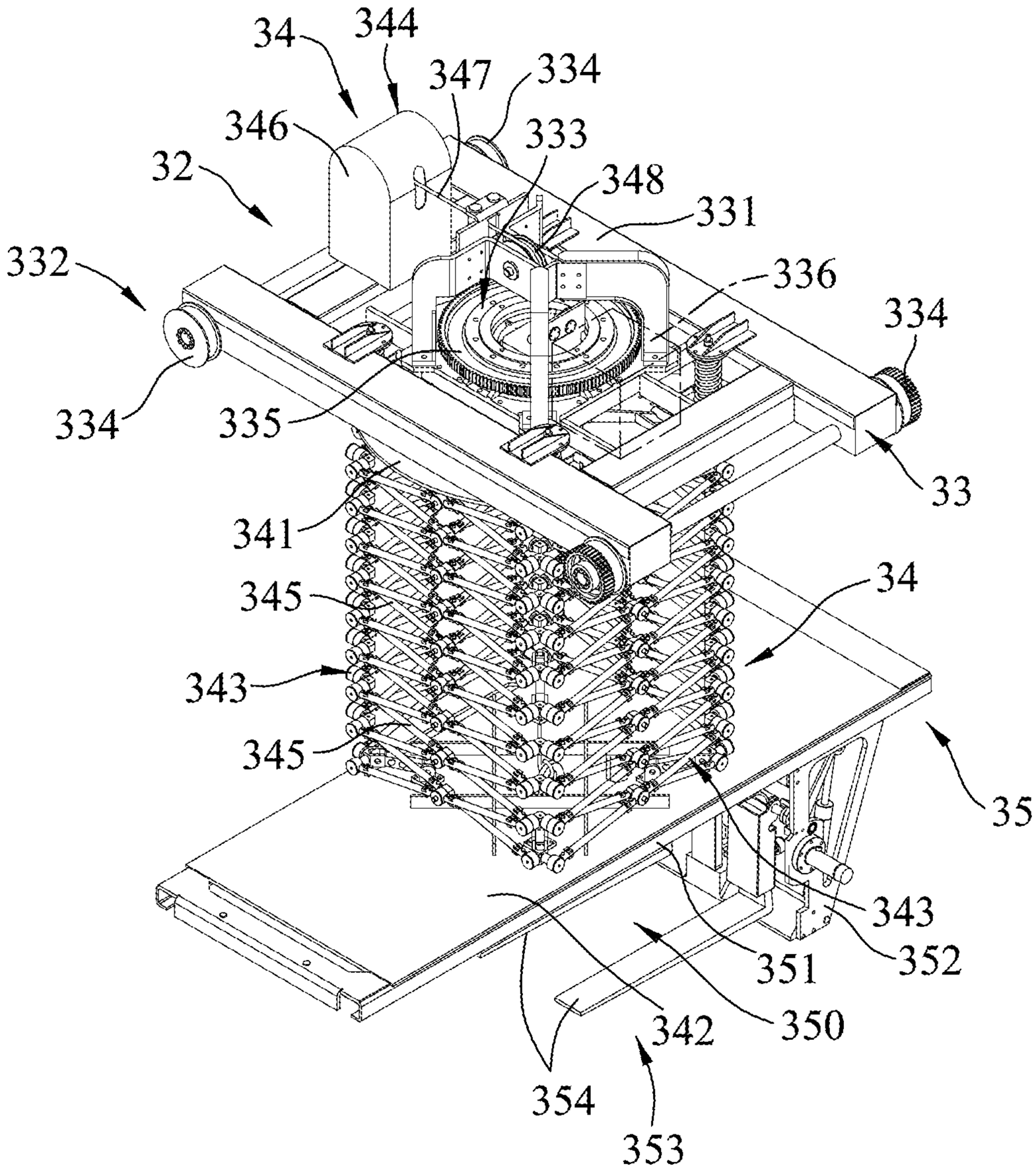
222
231
1
9
221
22
202
9
1
202
231
211
222

FIG.4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348
331
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336
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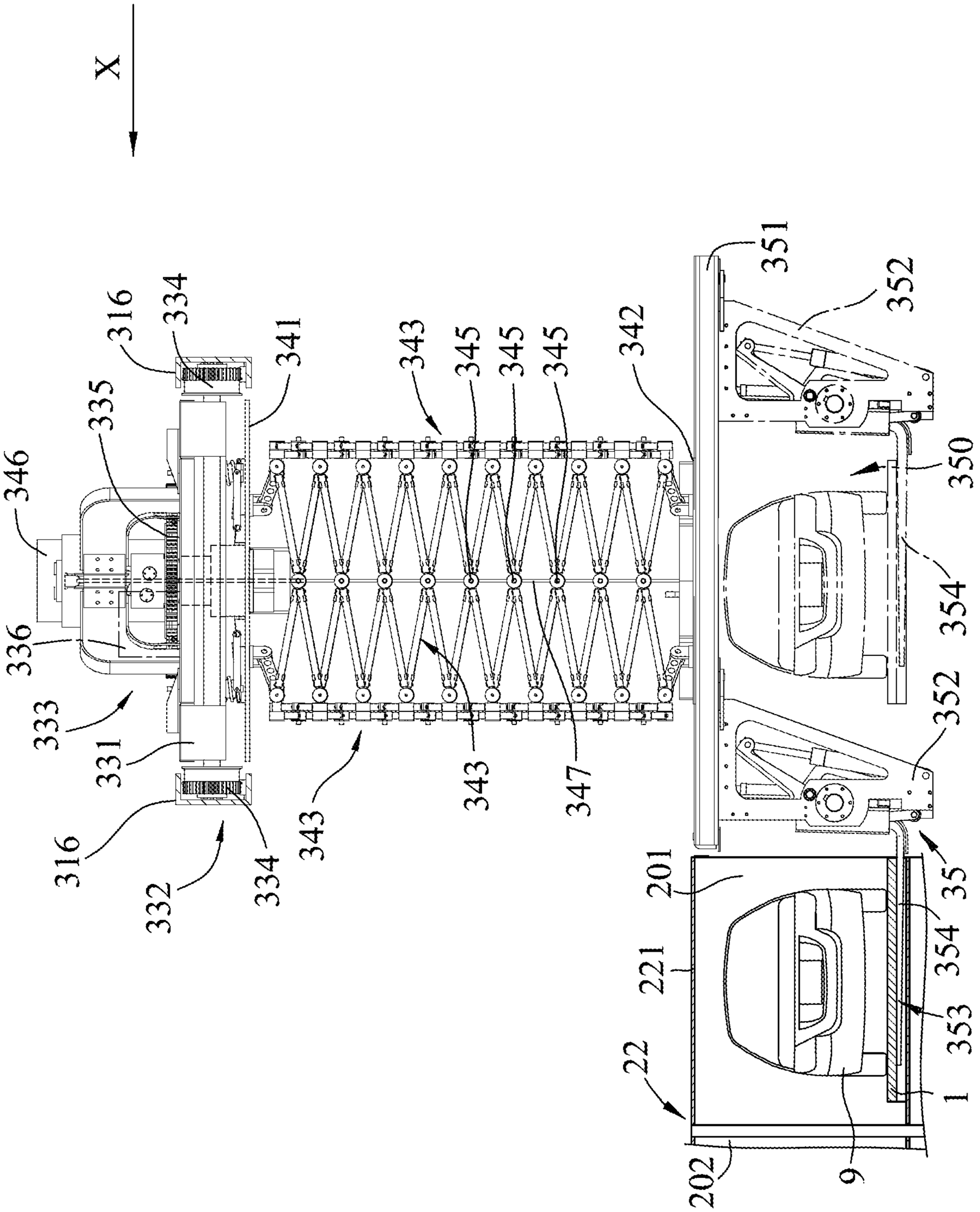
342
350
354
353

FIG.5


X
316
334
341
343
345
345
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342
335
346
336
333
331
343
347
343
316
332
334
351
352
350
354
352
201
221
22
202
9
1
353
354

FIG.6

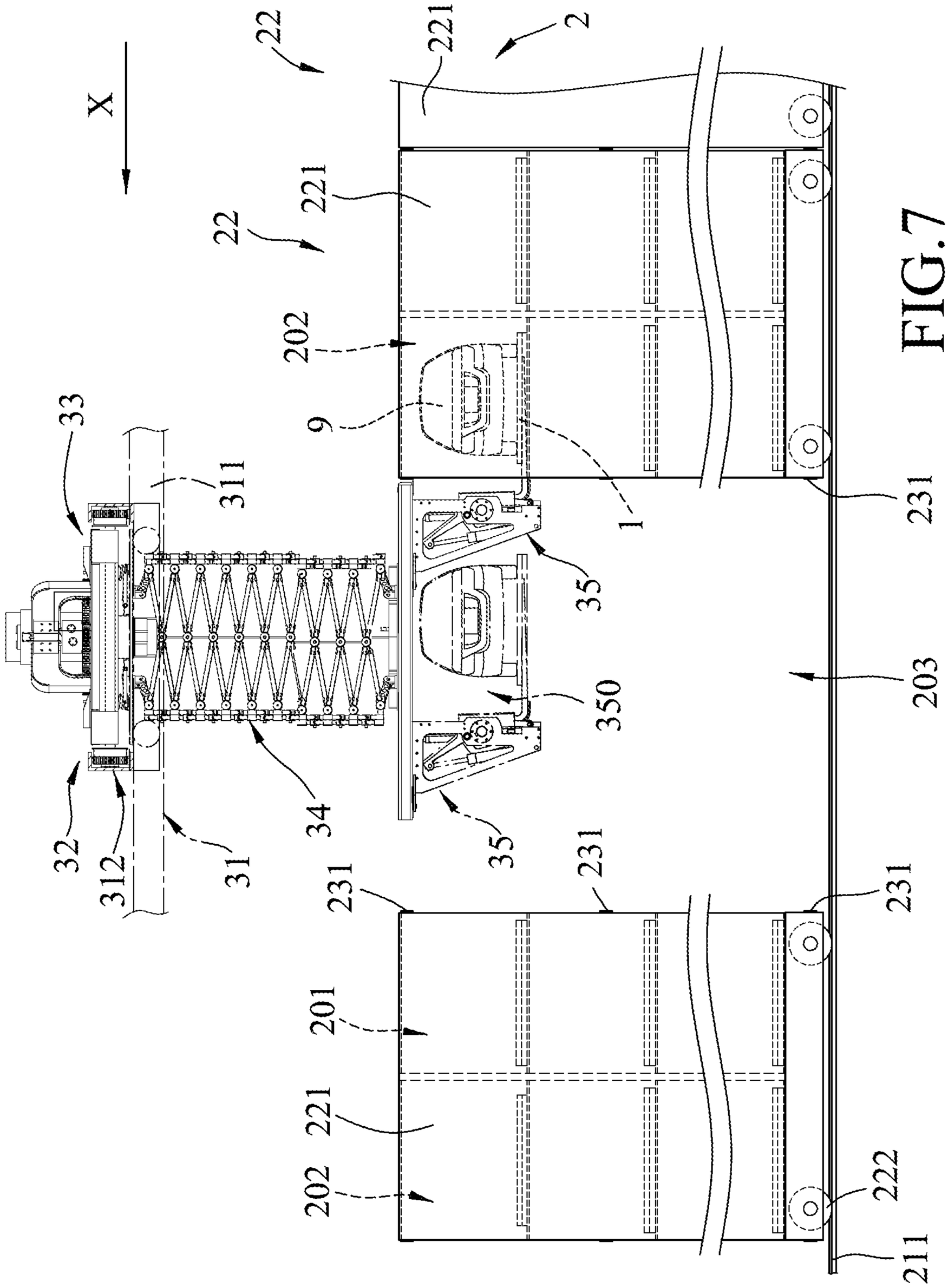
X
22
221
2
22
221
202
9
1
231
33
311
35
350
203
32
12
312
31
34
35
231
231
201
221
202
222
211

FIG.7

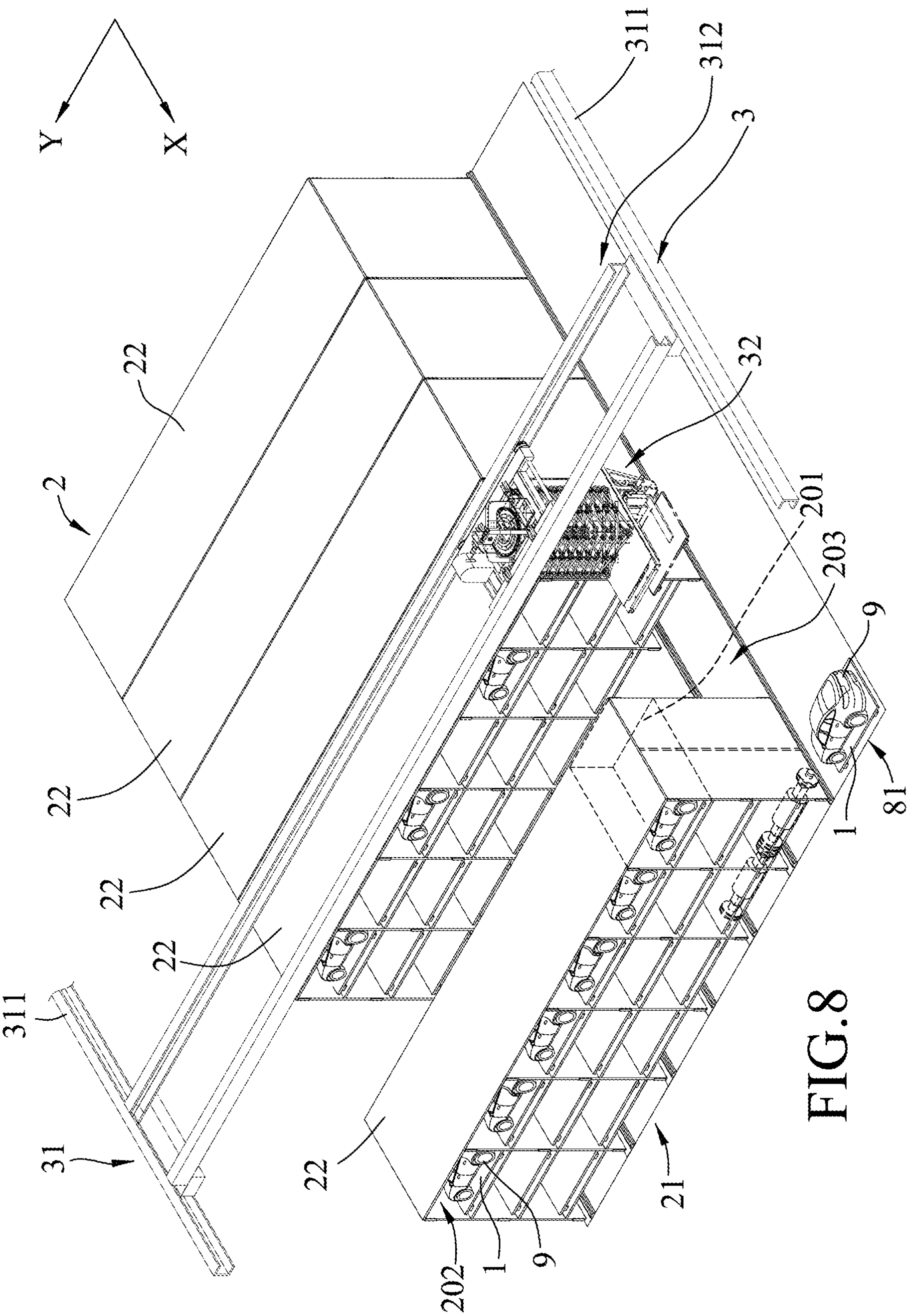

FIG.8

MECHANICAL PARKING GARAGE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority of Taiwanese Patent Application No. 108130043, filed on Aug. 22, 2019.

FIELD

The disclosure relates to a parking garage, and more particularly to a parking garage that uses a mechanical system to park vehicles.

BACKGROUND

A conventional mechanical parking garage includes a pallet for carrying a vehicle, a lifting unit for lifting the pallet vertically, a transporting unit for transporting the pallet horizontally, and two parking units respectively located on the left and right sides of the lifting unit. Each of the parking units includes a plurality of parking spaces arranged vertically and spaced apart from one another. To park the vehicle, a user drives the vehicle onto the pallet that is placed on the lifting unit. Then, the pallet carrying the vehicle is moved vertically next to an empty one of the parking spaces by the lifting unit, and is moved horizontally into the empty parking space by the transporting unit.

In comparison with a conventional non-multi-storey parking lot, more vehicles can be accommodated in such mechanical parking garage in the same land area. However, since the lifting and transporting units as a set cannot work with more than two parking units, if there were more parking units, more lifting and transporting units would be required as well, which will significantly increase the cost of installation and maintenance, as well as reducing the efficiency of land use.

SUMMARY

Therefore, the object of the disclosure is to provide a mechanical parking garage that can alleviate at least one of the drawbacks of the prior art.

According to the disclosure, a mechanical parking garage includes a plurality of pallets, a parking system and a transporting system. Each of the pallets is adapted for carrying a vehicle.

The parking system includes a rail track unit that is adapted to be mounted on the ground, and a plurality of tower units that are mounted on and slidable along the rail track unit. Each of the tower units has a plurality of first parking spaces, and each of the first parking spaces is disposed for storing one of the pallets.

The transporting system includes a rail mechanism that is mounted above the parking system, and a transporting mechanism that is mounted to the rail mechanism and that is horizontally movable.

Any adjacent two of the tower units are movable along the rail track unit relative to each other between a proximate state, where the adjacent two of the tower units are proximate to each other, and a distal state, where the adjacent two of the tower units are distal from each other and cooperatively define a transporting aisle therebetween.

The transporting system is operable to transport one of the pallets into one of the first parking spaces of one of the tower units via the transporting aisle between the one of the tower units and an adjacent one of the tower units.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the disclosure will become apparent in the following detailed description of the embodiments with reference to the accompanying drawings, of which:

FIG. **1** is a fragmentary perspective view of a first embodiment of the mechanical parking garage according to the disclosure;

FIG. **2** is an enlarged fragmentary perspective view of the first embodiment;

FIG. **3** is a fragmentary perspective view of a transporting system of the first embodiment;

FIG. **4** is a fragmentary side view of the first embodiment;

FIG. **5** is a perspective view of a transporting mechanism of the transporting system of the first embodiment;

FIG. **6** is a schematic view, illustrating a loading unit of the transporting mechanism being converted from a default state to an operating state to transport a vehicle into a first parking space;

FIG. **7** is another schematic view, illustrating the loading unit transporting a vehicle into a second parking space; and

FIG. **8** is a fragmentary perspective view of a second embodiment of the mechanical parking garage according to the disclosure.

DETAILED DESCRIPTION

Before the present disclosure is described in greater detail, it should be noted that where considered appropriate, reference numerals or terminal portions of reference numerals have been repeated among the figures to indicate corresponding or analogous elements, which may optionally have similar characteristics.

Referring to FIGS. **1**, **2** and **4**, a first embodiment of a mechanical parking garage according to the disclosure has an entrance **81** and an exit **82**, is adapted for accommodating a plurality of vehicles **9**, and is adapted to work with parking payment equipment having a management system (not shown). Since the parking payment equipment is well known in the art and is not the focus of the disclosure, it will not be described further hereinafter.

The mechanical parking garage includes a plurality of pallets **1**, a parking system **2**, a transporting system **3** and a conveying system **4**. Each of the pallets **1** is adapted for carrying one of the vehicles **9**.

In this embodiment, the parking system **2** includes a rail track unit **21**, a plurality of tower units **22** and a plurality of fixing units **23**. The rail track unit **21** is adapted to be mounted on the ground, and has a plurality of rail tracks **211** that extend in a first horizontal direction (X), and that are spaced apart in a second horizontal direction (Y) which is transverse to the first horizontal direction (X).

The tower units **22** are mounted on and slidable along the rail tracks **211** of the rail track unit **21**. Each of the tower units **22** includes a tower body **221**, a plurality of rail wheels **222** and a plurality of driving members **223**.

The tower body **221** of each of the tower units **22** has a plurality of first parking spaces **201** and a plurality of second parking spaces **202**. Each of the first and second parking spaces **201**, **202** is disposed for storing one of the pallets **1**, and has an opening. The opening of each of the first parking spaces **201** and the opening of each of the second parking spaces **202** face outwardly and oppositely. In this embodi-

ment, the opening of each of the second parking spaces **202** opens toward the first horizontal direction (X), and the opening of each of the first parking spaces **201** opens opposite to the first horizontal direction (X).

The rail wheels **222** of each of the tower units **22** are mounted to a bottom end of the tower body **221** and are rotatable along the rail tracks **211** of the rail track unit **21**. The driving members **223** of each of the tower units **22** are mounted to the bottom end of the tower body **221**, are connected to the rail wheels **222**, and are operable to drive the rail wheels **222** to rotate along the rail tracks **211**, thereby resulting in the sliding movement of the tower unit **22** in the first horizontal direction (X). In the present embodiment, each of the driving members **223** is an electric motor which draws electric power to drive the rotation of the rail wheels **222**; however, in other embodiments of the disclosure, each of the driving members **223** may be a hydraulic motor as long as it is capable of driving the rotation of the rail wheels **222**.

Any adjacent two of the tower units **22** are movable along the rail track unit **21** relative to each other between a proximate state, where the adjacent two of the tower units **22** are proximate to each other, and a distal state, where the adjacent two of the tower units **22** are distal from each other and cooperatively define a transporting aisle **203** therebetween. For example, referring specifically to the three tower units **22** in FIG. **4**, the left one and the middle one of the tower units **22** are in the distal state and the transporting aisle **203** is formed therebetween. On the other hand, the middle one and the right one (only partly shown) of the tower units **22** are in the proximate state.

Each of the fixing units **23** of the parking system **2** is disposed between an adjacent two of the tower units **22**, and includes a plurality of electromagnets **231** mounted to corresponding side ends of the adjacent two of the tower units **22**. When the adjacent two of the tower units **22** are in the proximate state, the electromagnets **231** are electrically charged to detachably attract each other, thereby securing the adjacent two of the tower units **22** together.

The conveying system **4** includes a first conveying mechanism **41** and a second conveying mechanism **42**.

The first conveying mechanism **41** extends in the first horizontal direction (X), and is connected to the entrance **81** of the mechanical parking garage. The first conveying mechanism **41** and the parking system **2** are arranged in the second horizontal direction Y) and are adjacent to each other. The second conveying mechanism **42** extends in the first horizontal direction (X), and is connected to the exit **82** of the mechanical parking garage. The second conveying mechanism **42** and the parking system **2** are arranged in the second horizontal direction (Y) and are adjacent to each other.

The first conveying mechanism **41** is operable for conveying one of the pallets **1** from the entrance **81** to the transporting aisle **203** between one of the tower units **22** and an adjacent one of the tower units **22**, such that the one of the pallets **1** can be transported by the transporting system **3** (details of which will be described later) through the transporting aisle **203** into one of the first parking spaces **201** of one of the tower units **22** or into one of the second parking spaces **202** of the adjacent one of the tower units **22**. In a similar manner, the second conveying mechanism **42** is operable for conveying the one of the pallets **1**, which is transported by the transporting system **3** from the one of the first and second parking spaces **201**, **202** to the transporting aisle **203**, to the exit **82**. In the present embodiment, the first and second conveying mechanisms **41**, **42** are conveyor belt mechanisms but are not limited thereto.

Referring to FIGS. **1**, **3** and **5**, in this embodiment, the transporting system **3** includes a rail mechanism **31** and a transporting mechanism **32**. The rail mechanism **31** includes two first rails **311**, a second rail **312** and a plurality of slider units **313**.

The first rails **311** of the rail mechanism **31** are mounted above the parking system **2**, extend in the first horizontal direction (X), and are spaced apart in the second horizontal direction (Y). The second rail **312** of the rail mechanism **31** includes two rail beams **314** that extend in the second horizontal direction (Y), and that are spaced apart in the first horizontal direction (X). The slider units **313** of the rail mechanism **31** are mounted to opposite ends of each of the rail beams **314** of the second rail **321**, and are mounted to and slidable along the first rails **311** such that the rail beams **314** of the second rail **312** are horizontally movable along the first rails **311**.

The transporting mechanism **32** of the transporting system **3** includes a railing device **33**, an elevating device **34** and a loading device **35**.

The railing device **33** of the transporting mechanism **32** includes a main base **331**, a railing unit **332** and a rotating unit **333**. The main base **331** is movably mounted, via the railing unit **332**, to the second rail **312** of the rail mechanism **31**, is movable along the second rail **312**, and is co-movable with the second rail **312** along the first rails **311**. The rotating unit **333** is co-movably mounted to the main base **331** and is rotatable about a vertical rotational axis.

Specifically, the railing unit **332** of the railing device **33** includes a plurality of rolling wheels **334** rotatably mounted to two opposite sides of the main base **331** in the first horizontal direction (X), and a control unit (not shown) for controlling the rotation of the rolling wheels **334**. It should be noted that the control unit may be a motor that is mounted to the main base **331**, or a chain assembly that is mounted to the second rail **312**, as long as it is capable of controlling the rotation of the rolling wheels **334**.

The rotating unit **333** of the railing device **33** includes a gear disk **335** and a steering subunit **336** that is mounted to the main base **331** for driving the gear disk **335** to rotate relative to the main base **331**.

Referring further to FIG. **6**, in this embodiment, the elevating device **34** of the transporting mechanism **32** includes an upper base **341**, a lower base **342**, four scissors units **343** (only three are visible in FIG. **6**) and a hoist **344**.

The upper base **341** of the elevating device **34** is disposed under and mounted to the railing device **33**. Specifically, the upper base **341** is co-rotatably mounted to the gear disk **335** of the rotating unit **333** of the railing device **33** such that the steering subunit **336** of the rotating unit **333** is able to drive the gear disk **335** and the elevating device **34** to rotate together.

The lower base **342** of the elevating device **34** is connected to the loading device **35**. The scissors units **343** of the elevating device **34** cooperatively form a rectangular framework connected between the upper and lower bases **341**, **342**, and are vertically extendable and contractible. The hoist **344** of the elevating device **34** is mounted to the railing device **33** for driving extension and contraction of the scissors units **343**.

Specifically, the scissors units **343** are configured to extend or contract synchronously, so that the lower base **342** can move steadily downward or upward relative to the upper base **341**. In view of the structure of the scissors units **343**, each of the scissors units **343** includes a plurality of criss-

cross members **345** that are vertically arranged and that are pivotally connected to each other. Each of the crisscross members **345** has two pivotally-connected rods forming a scissors mechanism, and has one end connected pivotally to a respective one of the crisscross members **345** of a horizontally-adjacent one of the scissors units **343**, and an opposite end connected pivotally to a respective one of the crisscross members **345** of another horizontally-adjacent one of the scissors units **343**.

The hoist **344** of the elevating device **34** of the transporting system **3** includes a rope reel **346**, a traction rope **347** and a guide wheel **348**.

The rope reel **346** is mounted to the main base **331** of the railing device **33**. The traction rope **347** is connected between the rope reel **346** and the lower base **342** of the elevating device **34**. The guide wheel **348** is mounted to the main base **331** of the railing device **33** for guiding the traction rope **347**, which is released from the rope reel **346**, to extend through the gear disk **335** and the rectangular framework of the scissors units **343**, and towards the loading device **35**. In such a manner, the rope reel **346** is operable for releasing and for retracting the traction rope **347** to thereby move the lower base **342** relative to the upper base **341**, resulting in the extension and contraction of the scissors units **343**.

The loading device **35** of the transporting mechanism **32** includes a connecting base **351**, a moving base **352** and a loading unit **353**.

The connecting base **351** is disposed under and mounted co-movably to the lower base **342** of the elevating device **34**. The moving base **352** is disposed under and mounted to the connecting base **351**, and is horizontally movable relative to the connecting base **351**.

Specifically, the connecting and moving bases **351**, **352** of the loading device **35** are connected via engagement between at least one groove (not shown) that is formed in one of the connecting and moving bases **351**, **352**, and at least one engaging block (not shown) that is formed in the other one of the connecting and moving bases **351**, **352**. The moving base **352** is movable relative to the connecting base **351** via control of a hydraulic unit (not shown) connected to a bottom end of the connecting bases **351**. However, details of the connecting and moving bases **351**, **352** are not the focus of the disclosure, and thus are not described further hereinafter.

The loading unit **353** of the loading device **35** is co-movably mounted to the moving base **352**, and includes two fork prongs **354** that are horizontally spaced apart from each other for loading and unloading one of the pallets **1**. The connecting base **351**, the moving base **352** and the loading unit **353** cooperatively define a loading space **350** to temporarily store one of the vehicles **9** with the one of the pallets **1**.

Specifically, to load and unload the one of the pallets **1**, the moving base **352** and the loading unit **353** are convertible relative to the connecting base **351** between an operating state and a default state. When the moving base **352** and the loading unit **353** are in the operating state, the fork prongs **354** protrude horizontally out of the connecting base **351**. When the moving base **352** and the loading unit **353** are in the default state, the fork prongs **354** remain under and do not protrude out of the connecting base **351**.

Referring to FIGS. **1**, **4** and **6**, a parking operation of the mechanical parking garage is exemplified by a process of transferring one of the vehicles **9** (hereinafter simplified as the vehicle **9**) from the entrance **81** to one of the first parking spaces **201** of the left one of the tower units **22** shown in FIG. **4**.

Before the vehicle **9** enters the mechanical parking garage, one of the pallets **1** (hereinafter simplified as the pallet **1**) that was disposed in the one of the first parking spaces **201** is moved to the entrance **81** in advance. A user drives the vehicle **9** through the entrance **81** and parks the vehicle **9** on the pallet **1**. Next, the user leaves the vehicle **9** and the left one of the tower unit **22** and the middle one of the tower units **22** (see FIG. **4**) are driven to convert to the distal state, in which the transporting aisle **203** is formed.

Meanwhile, the first conveying mechanism **41** is operated to transfer the vehicle **9** and the pallet **1** to the transporting aisle **203**, allowing another pallet **1** to be placed at the entrance **81** for loading another vehicle **9**.

Then, the transporting mechanism **32** is moved to be adjacent to the pallet **1** via the rail mechanism **31**, and the elevating device **34** extends downwardly such that the loading device **35** is approximately level with the pallet **1**. At the same moment, the steering subunit **336** of the rotating unit **333** of the railing device **33** is operated to rotate the gear disk **335**, the elevating device **34** and the loading device **35** together such that the fork prongs **354** of the loading unit **353** are steered toward the pallet **1**. Next, the loading unit **353** is converted from the default state to the operating state such that the fork prongs **354** are disposed right under the pallet **1**. Then, the pallet **1** and the loading unit **353** are lifted together by the elevating device **34** to be away from the first conveying mechanism **41**, and the loading unit **353** is converted from the operating state back to the default state. The pallet **1** and vehicle **9** are hence temporarily stored in the loading space **350** under the elevating device **34** and can be moved with the transporting mechanism **32** to the one of the first parking spaces **201** via the transporting aisle **203**.

Afterward, the steering subunit **336** of the rotating unit **333** is operated again to rotate the gear disk **335**, the elevating device **34**, and the loading device **35** together with the pallet **1** such that the fork prongs **354** are steered toward the opening of the one of the first parking spaces **201**. During the above-mentioned process, the rectangular framework of the scissors units **343**, by virtue of its sturdy structure and stable movement, is able to prevent the pallet land the vehicle **9** from shaking, thereby ensuring a smooth and steady transporting process.

Finally, the loading unit **353** is converted from the default state to the operating state such that the pallet **1** and the vehicle **9** are conveyed into the one of the first parking spaces **201**, and the elevating device **34** is slightly lowered so that the pallet **1** is placed on a ground surface in the first parking space **201**. Next, the loading unit **353** is converted from the operating state back to the default state, and the fork prongs **354** of the loading unit **353** are moved away from the pallet **1** to complete the parking operation of the vehicle **9**. At this moment, the transporting mechanism **32** can leave the transporting aisle **203**, and the left and middle ones of the tower units **22** shown in FIG. **4** can be moved from the distal state to the proximate state.

It should be noted that when two or more of the tower units **22** are in the proximate state, they are secured to each other by the fixing units **23**. Compared to a height-to-depth ratio of a single one of the tower units **22**, a height-to-depth ratio of multiple interconnected tower units **22** is reduced; in other words, the height-to-depth ratio decreases as the number of the tower units **22** increases. Thus, the overall structure becomes more stable and sturdy, and the tower

units **22** are at lower risk of being tipped over by any external influence, such as a shock wave of an earthquake.

Referring to FIG. **7**, if the vehicle **9** is to be parked in one of the second parking spaces **202**, the fork prongs **354** are steered toward the opening of the one of the second parking spaces **202**, which is opposite to the opening of the one of the first parking spaces **201**. The rest of the operation is the same as mentioned above, and therefore will not be described further.

When the user needs to retrieve the parked vehicle **9**, the above-mentioned process is operated in reverse. However, instead of transporting the pallet **1** and the vehicle **9** back to the first conveying mechanism **41**, the pallet **1** and the vehicle **9** are transported to the second conveying mechanism **42**, which in turn transports the pallet **1** and the vehicle **9** to the exit **82**.

It should be noted that each of the tower units **22** is not limited to having two sets of parking spaces with opposite openings (i.e. the first and second parking spaces **201**, **202**). In other variations of the present embodiment, each of the tower units **22** may have just one set of the first and second parking spaces **201**, **202**.

It should also be noted that the number of the scissors units **343** is not limited to four. In practice, the elevating device **34** may includes three or five of the scissors units **343** forming a hollow triangular or pentagonal prism as long as the structure is stable and can be extended and contracted synchronously in one direction.

Moreover, the number of the tower units **22** and the number of the first and second parking spaces **201**, **202** that each of the tower units **22** has may both vary depending on actual requirements. For example, the parking system **2** may include eight tower units **22**, each of which has thirty-six first parking spaces **201** and thirty-six second parking spaces **202**, so that a total of five hundred seventy-six vehicles **9** can be parked. Suppose dimensions of each of the first and second parking spaces **201**, **202** are approximately five-point-five meters by two meters, a total area of the parking system **2** excluding the transporting aisle **203** is approximately eighteen hundred eighty-one square meters. Adding spaces to accommodate the transporting system **3** and the conveying system **4**, a total floor area of approximately thirty-three hundred and six square meters can be used for parking five hundred seventy-six vehicles **9**, that is to say, each of the vehicles **9** only occupies about five-point-seven square meters of the area on average. Moreover, as a height of the mechanical parking garage increases, the average area occupied by each of the vehicles **9** decreases, thereby increasing the efficiency of land use.

Referring to FIG. **8**, a second embodiment of the mechanical parking garage according to the disclosure is similar to the first embodiment. The main difference between the two embodiments resides in that there is no conveying system **4** in the second embodiment.

Specifically, after the vehicle **9** enters the entrance **81** and is parked on the pallet **1**, the transporting system **3** directly transports the vehicle **9** and the pallet **1** from the entrance **81** through the transporting aisle **203** and into, for example, the one of the first parking spaces **201**. Similarly, to retrieve the vehicle **9**, the transporting system **3** directly transports the vehicle **9** and the pallet **1** from the one of the first parking spaces **201** through the transporting aisle **203**.

In summary, the mechanical parking garage according to the disclosure has advantages as follows.

By virtue of the tower units **22** being movable relative to each other, the transporting aisle **203** can be formed between any adjacent two of the tower units **22** at demand. Therefore, without having a permanent transporting aisle reserved between every adjacent two of the tower units **22**, the efficiency of land use is greatly improved compared with the prior art.

In addition, by virtue of the rail mechanism **31** of the transporting system **3**, the transporting mechanism **32** is able to move to any of the first and second parking spaces **201**, **202**, that is, only one transporting system **3** is needed to cover the whole mechanical parking garage, regardless of the number of the tower units **22**, which is more cost-efficient compare with the prior art.

In the description above, for the purposes of explanation, numerous specific details have been set forth in order to provide a thorough understanding of the embodiments. It will be apparent, however, to one skilled in the art, that one or more other embodiments may be practiced without some of these specific details. It should also be appreciated that reference throughout this specification to "one embodiment," "an embodiment," an embodiment with an indication of an ordinal number and so forth means that a particular feature, structure, or characteristic may be included in the practice of the disclosure. It should be further appreciated that in the description, various features are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of various inventive aspects, and that one or more features or specific details from one embodiment may be practiced together with one or more features or specific details from another embodiment, where appropriate, in the practice of the disclosure.

While the disclosure has been described in connection with what are considered the exemplary embodiments, it is understood that this disclosure is not limited to the disclosed embodiments but is intended to cover various arrangements included within the spirit and scope of the broadest interpretation so as to encompass all such modifications and equivalent arrangements.

What is claimed is:

1. A mechanical parking garage comprising:

a plurality of pallets, each of said pallets being adapted for carrying a vehicle;

a parking system including

a rail track unit that is adapted to be mounted on the ground, and

a plurality of tower units that are mounted on and slidable along said rail track unit, each of said tower units having a plurality of first parking spaces, each of said first parking spaces being disposed for storing one of said pallets; and

a transporting system including

a rail mechanism that is mounted above said parking system, and

a transporting mechanism that is mounted to said rail mechanism and that is horizontally movable;

wherein any adjacent two of said tower units are movable along said rail track unit relative to each other between a proximate state, where said adjacent two of said tower units are proximate to each other, and a distal state, where said adjacent two of said tower units are distal from each other and cooperatively define a transporting aisle therebetween; and

wherein said transporting system is operable to transport one of said pallets into one of said first parking spaces of one of said tower units via said transporting aisle between said one of said tower units and an adjacent one of said tower units.

2. The mechanical parking garage as claimed in claim 1, wherein said transporting mechanism of said transporting system includes:

a railing device that includes a main base movably mounted to said rail mechanism and being horizontally movable, and a rotating unit mounted co-movably to said main base and rotatable about a vertical rotational axis;

an elevating device that is disposed under and mounted to said railing device, that is connected co-rotatably to said rotating unit of said railing device, and that is vertically extendable and contractible; and

a loading device that is disposed under and mounted co-movably to said elevating device for loading and unloading each of said pallets.

3. The mechanical parking garage as claimed in claim 2, wherein said rotating unit of said railing device includes a gear disk to which said elevating device is mounted, and a steering subunit which is mounted to said main base for driving said gear disk and said elevating device to rotate together.

4. The mechanical parking garage as claimed in claim 1, wherein:

each of said tower units further has a plurality of second parking spaces, each of said second parking spaces being disposed for storing one of said pallets; and

each of said first and second parking spaces has an opening, said opening of each of said first parking spaces and said opening of each of said second parking spaces facing outwardly and oppositely.

5. The mechanical parking garage as claimed in claim 1, wherein said rail mechanism of said transporting system includes:

two first rails mounted above said parking system, extending in a first horizontal direction, and being spaced apart in a second horizontal direction which is transverse to the first horizontal direction; and

at least one second rail extending in the second horizontal direction, mounted to said first rails, and being movable along said first rails, said transporting mechanism of said transporting system being mounted to said at least one second rail, being movable along said at least one second rail, and being co-movable with said at least one second rail along said first rails.

6. The mechanical parking garage as claimed in claim 1, wherein said parking system further includes at least one fixing unit that is disposed between an adjacent two of said tower units, and that includes a plurality of electromagnets mounted to corresponding side ends of said adjacent two of said tower units and detachably attracting each other to secure said adjacent two of said tower units together when said adjacent two of said tower units are in the proximate state.

7. The mechanical parking garage as claimed in claim 2, wherein said elevating device of said transporting system includes:

an upper base connected to said railing device of said transporting system;

a lower base connected to said loading device of said transporting system;

at least one scissors unit connected between said upper and lower bases and vertically extendable and contractible; and

a hoist mounted to said railing device for driving extension and contraction of said at least one scissors unit.

8. The mechanical parking garage as claimed in claim 7, wherein said hoist of said elevating device of said transporting system includes:

a rope reel that is mounted to said railing device of said transporting system;

a traction rope that is connected between said rope reel and said lower base of said elevating device; and

a guide wheel that is mounted to said railing device for guiding said traction rope released from said rope reel towards said loading device, said rope reel being operable to release and to retract said traction rope to thereby move said lower base relative to said upper base to result in the extension and contraction of said at least one scissors unit.

9. The mechanical parking garage as claimed in claim 2, wherein said loading device of said transporting mechanism of said transporting system includes:

a connecting base disposed under and mounted to said elevating device of said transporting mechanism;

a moving base disposed under and mounted to said connecting base, and being horizontally movable relative to said connecting base; and

a loading unit co-movably mounted to said moving base for loading and unloading each of said pallets.

10. The mechanical parking garage as claimed in claim 1, further comprising a conveying system including:

a first conveying mechanism that is connected to an entrance of said mechanical parking garage, and that is operable for conveying said one of said pallets to said transporting aisle between said one of said tower units and said adjacent one of said tower units to be transported by said transporting system into said one of said first parking spaces of said one of said tower units; and

a second conveying mechanism that is connected to an exit of said mechanical parking garage, and that is operable for conveying said one of said pallets, which is transported by said transporting system from said one of said first parking spaces to said transporting aisle, to said exit.

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